The conclusions that these tables enable us to draw are, that we feel a sensation of cold more quickly than one of heat, though the difference is slight; again, that we re-act more quickly to sensations of contact than to those of temperature. If the stimulation be applied to the same spot repeatedly and at short intervals, the time is in general lengthened. This was found to be true for the forehead and cheek, for sensations of cold, after a very few minutes. The same is true for the forehead with the stimulation by heat; but on the cheek after fifteen minutes, with the time taken each minute, there was no such lengthening of the time. More details regarding the method of obtaining these results will be given in a future paper.

The same topic has also been investigated by Dr. Goldscheider (*Archiv für Anat. und Phys.*, 1887, v.). His method was to approach a metal ball to the skin, thus breaking an electric connection and re-acting by a simple movement of the jaw. To get reliable results, he chose parts with a thin epidermis, and used an intense stimulus. For cold, the ball was at a temperature of 15° C.; and for warmth, at a temperature of 50°C. In all, over two thousand observations were made. The average of all these times was, for cold, on the face, near edge of the eyelid, .135, on upper arm .150, on the abdominal surface .226, and on the inner surface of the thigh .255, of a second. Corresponding times for the perception of warmth on the four places were .190, .270, .620, and .790 of a second. Warmth is thus much more slowly perceived than cold, and the more so the farther from the brain the part of the body tested, the difference amounting in the lower limbs to nearly half a second. It should be said that care was taken to choose parts of equal sensibility in the several regions of the body. If the stimulation is only moderately strong, and especially if the stimulation is weak, the re-action time is much lengthened. For example: a moderately warm stimulus on the arm takes .46 to .54 of a second to be re-acted upon, and, if the stimulus is weak, it takes .90 of a second to 1.1 seconds. That this lengthening of the time is really an effect of the intensity of the stimulus, is shown by the fact that it occurs in weak stimulation of the most sensitive areas, and not only in strong stimulation of insensitive areas, as would be the case were the lengthening due to the slow radiation through the epidermis. These facts are all in good accord with former investigations of the topic. The explanation of this difference between the re-action time for heat and for cold cannot yet be given. But Dr. Goldscheider is not ready to ascribe it to the fact that the one sensation passes up the white columns of the cord and the other through the gray matter. The results of the two investigations agree fairly well on the time for the perception of cold, but the latter gives much higher values for the re-action time to a warm stimulus.

VISUAL UNITS IN THE RETINA. — In viewing a series of uniformly scattered dots, we will at a certain distance be able to recognize them as dots; but if the object be further removed, they will fuse into a more or less uniform surface. By testing back and forth, one can quite accurately determine the distance from the eye at which the dots are just visible as single dots, and, if we measure the distance between the dots, it is possible to calculate how large a surface on the retina is necessary to impress us with the vision of a separate dot. Such a surface would be a visual unit, and the point of importance is to find what anatomical basis there is for this physiological unit. In 1881 Carl Du Bois-Reymond measured the size of these visual units in the fovea, or yellow spot of the retina, and found that such a unit was exactly the size of a cone at this point. He did not use dots, but rays of light shining through holes in a screen. This makes it extremely probable that a cone is the anatomical unit of vision. Dr. Wertheim (*Graefe's Archiv*, 1887) has continued these determinations for the lateral parts of the retina, where the vision is less fine, and where it is in general known that the number of cones is fewer. In tracing the decrease in the number of visual units to a certain area as we go upwards from the centre of the fovea, he gets a curve, showing at first a marked decrease, then a short period of almost no change, and then a long period of slow, regular decrease. If we ask, How does this harmonize with the anatomy? the answer cannot be as definite as we would wish. The part of the curve showing a marked decrease corresponds to the outer parts of the yellow spot; and the ratio between the number of visual units at the edge of this, compared to the number in an equal surface of the centre, is as one to two or three, while the ratio of the number of the cones in the two places is about as one to three or four. The next period of the curve cannot be thus compared, because the size of the yellow spot is differently determined by different observers. With regard to the lateral portions of the retina, it can be said that the largeness of the visual units makes it necessary that the cones be separated, and this the anatomy bears out. The general conclusion is, then, that the cones are very probably the anatomical basis for the visual units, and that the rods (that become more numerous as we recede from the centre of the fovea) cannot convey the sensation of a single objective point.

THE PSYCHOLOGY OF JOKING. — Dr. Hughlings-Jackson publishes some interesting remarks on this topic in the *Lancet* of Oct. 27. He regards punning as the lowest stage of the evolution of humor, but even in the pun he sees a material for the study of normal mentation. In a pun we have two ideas called to the mind at once, — a double vision, as it were; and, as all thought is the comparison of relations, this is simply a caricature of the normal process of thought. Again: the world owes a great debt to the first punster, because he began the 'play' of the mind (in the same sense as art is founded on the play-instinct), and so detached himself from the grossly useful, and showed a surplus energy capable of developing into the highest traits of mankind. To lack a sense of humor is a bad thing. "The man who has no sense of humor, who takes things to be literally as distinct as they superficially appear, does not see fundamental similarities in the midst of great superficial differences, overlooks the transitions between great contrasts. I do not mean *because* he has no sense of humor, but because he has not the surplus intellect which sense of humor implies." Again: "I think that observation confirms what *a priori* seems likely, — that *pari passu* with the evolution of the sentiment of jocosity (playing at unreality) is the evolution of power of realistic scientific conception, — from sense of the merely ridiculous with parallel realistic conception of simple things, up to sense of humor with parallel realistic conception of complex things." Dr. Jackson then looks upon punning as a 'mental diplopia' in which there is a double mental vision, but not of the kind conducive to useful ends. It is something like the thought in dreams. He sums up his view in these words: "The process of all thought is double, in degrees from a stereoscopic unity of subject and object to manifest diplopia (two objective states in one subject). The process of all thought is tracing relations of resemblance and difference, from simplest perception — to say what a thing is, is to say what it is like and unlike — up to most complex abstract reasoning. The formula of the caricature of the normal process of thought is the 'pretence' of some resemblance between things vastly different, from punning, where the pretended resemblances and real differences are of a simple order, up to humor, where both are highly compound. We have the 'play' of mind in three degrees of evolution, three stages of increasingly complex incongruousnesses."

BOOK-REVIEWS.

Geology and Mining Industry of Leadville, Colorado. With Atlas. By SAMUEL FRANKLIN EMMONS. (U.S. Geol. Surv., Monograph XII.) Washington, Government. 4°.

THE magnificent volume in which the geology of the Mosquito Range, and more particularly that of the environment of Leadville, Col., and its mining industry, is described, contains the results of investigations begun in 1879, at the instance of Clarence King, first director of the United States Geological Survey, and continued until May, 1881. Abstracts of the results of these investigations have been published in the 'Second Annual Report of the Director of the Survey,' but it is only now that the full work and the magnificent atlas have been issued. We will cull only a few points from this great work which are of general interest. The first part of the book deals with geology. A brief history of the discovery and growth of the Leadville region is given. Emmons demonstrates that the paleozoic and mesozoic strata lie unconformably on the Archæan, and, what is of the greatest importance, that the formation which is immediately adjacent to the Archæan varies from

place to place. At one point triassic beds, sloping away at varying angles from the flanks of the mountain, rest directly upon the Archæan beds; at another point, the lower beds of the cretaceous; at still another, and this more rarely, the carboniferous limestones are exposed, resting against the Archæan; while above them, always conformable, are found the triassic, Jurassic, and cretaceous formations, as one follows the section in an ascending geological sense. These facts make it evident that these beds have not been folded into a long anticlinal fold, the crest of which was subsequently planed off by erosion, but that the exposed Archæan parts represent an ancient continent or island along whose shores the younger beds were deposited. The lithological character of the series confirms this view, as they bear internal evidence of being a shore deposit. The Colorado Range is the most extensive of these ancient land-masses. Originally the western boundary of the Park area consisted of two or more masses, forming a general line of elevation parallel to the Colorado Range. Through the south-eastern portion of this area, and parallel with its longer axis, runs the valley of the Upper Arkansas River, which, however, during paleozoic and mesozoic times, did not exist.

The Mosquito Range was not formed until the great dynamic movement in the Rocky Mountain region at the close of the cretaceous. Enormous masses of eruptive rocks are found in this region crossing the sedimentary strata to greater or less elevations, and then spreading out in immense sheets along the planes of division between the different strata. From the fact that these interbedded sheets of eruptive rocks are found practically conformable with their bounding strata, and, like them, folded into sharp folds and cut off by faults, Emmons concludes that the eruptive activity preceded the uplift of the Mosquito Range. The latter was effected by a pushing-together from the east and from the west, a secondary movement acting in a north-and-south direction. The Archæan masses, between which the conformable series was deposited, the resistance of which caused the crumpling of the beds, must have participated in the folding.

A special chapter is devoted to the discussion of the geological phenomena and theoretical questions. The most important of these are the discussion on the folds and faults, and a comparison of the monoclinal folds and the great faults of the Great Basin with those of the Rocky Mountains. Emmons believes that the former are folds similar to those of the eastern mountainous region. He considers them true plications, and believes, that, could the structure beneath the valley be seen, the missing faulted-down members of the fold would be found. His principal objection against the reading of the geological structure of the Great Basin accepted by many scientists, that it is a region of faulted blocks uplifted in different directions, and practically without plication, is, that this theory would involve the actual annihilation of considerable wedge-shaped segments of stratified beds by the simple action of faulting. His theories of the origin of mountain-ranges are in accordance with Suess's theories. He denies the existence of an uplifting force, but considers the faults as caused by contraction and consequent sinking, while the folding is caused by tangential pushing and crumpling of superficial strata of the earth's crust. Another object which he discusses fully is the origin of dolomites and serpentine, the origin of the intrusive masses, and the improbability of sedimentary rocks being absorbed by eruptive masses.

The second part of the volume deals with the mining industry, with the origin of the metal deposits, and the methods of smelting. The atlas contains, besides numerous sections, a reprint of the Hayden map of Central Colorado, and a topographical map of the Mosquito Range drawn so that the light falls from the north-west and at an angle of 45° upon the mountains, by which method the topographical features appear very clear and distinct.

An Inquiry into Socialism. By THOMAS KIRKUP. New York, Longmans. 12°.

THE author of this book declares himself a socialist, but he means by socialism something quite different from what usually passes by that name. He does not favor communism, nor State socialism, nor an equal division of property; and he condemns all anarchical and revolutionary methods. He would extend the powers of government to a certain extent, especially in the municipalities. But he means by socialism chiefly what other folks call co-operation, — the ownership of the means of production by voluntary associations of laborers. He remarks, as many others have done before him, that the main defect in our present industrial organization is the divorce of the laborers from land and capital. But as the individual ownership of land and capital is becoming impossible, the only way out of the difficulty is by the joint ownership of both by associations of laborers. Yet he does not propose, like most of those who call themselves socialists, to take the property away from those who now possess it without giving them compensation: he proposes to pay for it. Moreover, he does not favor doing it by the action of the State, but by the gradual extension of voluntary co-operation. In short, he lays down as the cardinal principle of socialism, that, "whereas industry is at present carried on by private capitalists served by wage-labor, it must in the future be conducted by associated or co-operating workmen jointly owning the means of production" (p. 94).

Now, it is clear that such a system as this is very different from what is commonly called socialism, and we believe that most of those that style themselves socialists would repudiate it. Certainly they show at present no inclination toward voluntary co-operation; for if they really favored it, as Mr. Kirkup does, they would set about organizing co-operative societies. We admit, however, that Mr. Kirkup's socialism is a great improvement on that which is commonly so called; but then it does not differ essentially from what economists have always advocated under the name of 'co-operation.' Most economists of the orthodox school would disagree with Mr. Kirkup in regard to extending the functions of government; but otherwise they would have little to say against the system he advocates as an ideal for the future. He paints the evils of the present system, with its millionnaires and its beggars, in a vivid light, and with too little attention to its better features; yet he admits that skilled laborers, at least, are better off now than formerly. With regard to the prospects of the system he advocates, he does not speak in the most sanguine terms; and he clearly recognizes the difficulties in the way of its establishment. Indeed, he expressly says, that, "without a great moral advance, socialism may be regarded as impracticable" (p. 159), — an opinion in which most advocates of co-operation will be likely to agree. Mr. Kirkup's style is fairly good, and he has made an interesting book; but we very much doubt if it will meet with much approval among the mass of those who call themselves socialists; while at the same time his use of the term 'socialism' to designate the system he advocates is liable to raise a prejudice against it in the minds of others.

NOTES AND NEWS.

M. MOISSAN describes, in the *Annales de Chimie et Physique*, his long-continued experiments for isolating fluorine. While all former attempts to reach this result failed, M. Moissan, after many failures and disappointments, succeeded in his endeavors by electrolyzing anhydrous hydrofluoric acid in which the double fluoride of potassium and hydrogen was dissolved. *Nature*, in describing Moissan's experiments, gives a *résumé* of the remarkable qualities of fluorine as observed by Moissan. Sulphur, brought near the orifice, at once melted and inflamed; selenium behaved in like manner; as did also tellurium, with incandescence, forming fumes, and becoming coated with a solid fluoride. Phosphorus at once took fire, forming tri-, penta-, and oxyfluorides. Powdered arsenic and antimony combined with incandescence, the former yielding drops of AsF_3. A fragment of iodine placed in the gas combined, with production of a pale blue flame; in an atmosphere of iodine vapor, fluorine itself burned with a similar flame. Vapor of bromine lost its color, and the combination was sometimes accompanied by detonation. Cold crystalline silicon at once became incandescent, and burned with great brilliancy, sometimes with scintillations. On closing the little tubes containing it with the thumb, and opening under water, the silicon tetrafluoride formed was absorbed and decomposed, with precipitation of silica. Any undecomposed silicon was found to have been fused. Debray's adamantine boron also burned in the gas, becoming incandescent, and giving off fumes. Fluorine has a most extreme affinity for hydrogen: they combine in the dark, with explosion. In one of the